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MARINE CORPS BASE (MCB)
CAMP LEJEUNE, NORTH CAROLINA

PUBLIC MEETING CONCERNING
OPERABLE UNIT (OU) 19, SITE 84
AND
OPERABLE UNIT (OU) 16, SITE 89

MR. RICH BONELLI - MICHAEL BAKER CORPORATION (OU 19, SITE 84)

MR. SCOTT BAILEY - CH2MHILL (OU 16, SITE 89)

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Coastal Carolina Community College
Jacksonville, North Carolina

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MR. RICH BONELLI: I'm here to talk about Site 84, which is IR site -- Operable Unit number 19. I'm here tonight to talk about the proposed plan to complete a non-time critical removal action, and this would be involving removal of the building foundation, along with some soils around the building itself. Site 84 was formerly known as building 45, and is currently located just before you get to the main entrance to the base. Some of you may have seen the structure right before you get into the main gate off to your right-hand side there. Right now, currently there's only, like, a silt fence up, kind of around the old structure, but it used to be a substation. To just kind of give you a point of reference as to where that is. Again, you pull into the main gate, Site 84 is right on the right-hand side before you get to the main gate there. I'm trying to show you some photos of what it looks like right now. It's kind of a view standing behind the current structure right now. Highway 24 is on the other side. Again, it used to be a two-story building at one time. Currently, right now, there's only the floor with a basement. Everything else has been removed. As far as the history, at one time the building was a substation. It was a substation from the '30's to about 1942. Later, in 1965, the base purchased the property and converted the structure into a heavy equipment maintenance facility. From 1991 to 2000, there have been a lot of investigations conducted at this site. It's an interesting site in that there's really two areas of concern. There's an area, which right now is being handled under the Underground Storage Tank program, and there is also an area that we're dealing with on the IR side that mostly deals with the PCB's, so that this is -- when I show up all the investigations here. These are investigations that have occurred on the UST side and the IR side. The site drawing of current site conditions: building 45 is in this area right here. The investigations that we have just completed under the IR program pretty much have been conducted in this area of the site where the PCB's were found. I mentioned about the UST investigations or the site partially being started under the UST program. Those investigations are primarily being conducted in this side of the site and back here. We've been primarily interested in what's been going on from the PCB problem at the site, which has been to locate it around the building and this area here towards Northeast Creek. In August of this year, we just completed the field program for the IR study, and we've noted that there are several areas of concern. Again, we're primarily interested, for this meeting tonight, to talk about the building -- soils around the building -- but as far as what we've found to date, there have been PCB's identified around the building area, as well as the lagoon, that formerly was reported to have transformers in there. We've also found low levels of PCB's in the soils, as well, throughout various portions of the site. In addition to PCB's, we've also found petroleum contaminant in soils around the building itself, again tied into the UST's that were formerly out there. Groundwater, low levels of VOC's and SVOC's. Fortunately, there have been no detections of PCB's in the monitoring wells that we've sampled. As far as surface water and sediment, there's no apparent impact to Northeast Creek. We took a number of surface water and sediment samples from that water body. Really, the only PCB's found in the water body has been in the lagoon, which will be addressed later on when we get to the remedial action following the ROD. As far as the scope of work for the non-time critical removal action, again, what we're talking about doing is removing the existing building foundation and removing any of the impacted soils around that building itself. Basically, what we're going to be doing is taking the foundation out, taking the materials out. We'll be doing some field testing, doing the excavation work, testing for PCB's, and we'll be taking that contaminated soil off-site. Other areas of the site, again, are being -- will be studied or will be cleaned up. Once this interim action is completed, there is -- like the lagoon, some of the other areas of soil contamination will be addressed at that time. Pull up a map here and kind of give you an idea of...

MR. JIM SWARTZENBERG: Where are you going to take the foundation?

MR. KIRK STEVENS: What was the question? Where are you going to take the foundation?

MR. JIM SWARTZENBERG: Where are you going to take it? Yes.

MR. RICH BONELLI: It's my understanding, Jim, I guess, that the foundation material needs to be tested for PCB's. There will be some wipe samples tested, and so forth. I guess, depending on the concentration, will dictate where it would go to.

MR. KIRK STEVENS: The concentration of PCB's determines the final resting place for PCB contamination. The intention is that all the concrete and steel materials will be cleaned and would be routed to recycling at the (inaudible). The soils, depending on the level of contamination, will go off-site.

MR. JIM SWARTZENBERG: So you're assuming that the foundation and steel and concrete is not going to be -- it's not going to impact the management.

MR. KIRK STEVENS: If it is contaminated, it can be cleaned very easily.

MR. JIM SWARTZENBERG: Okay.

MR. RICH BONELLI: To kind of give you an idea of what we're talking about here, again, here's the building itself, the foundation. The drawing I'm showing you right now are impacted soils, we call them surface soils, down to about a foot. What we've identified right now has been a couple of areas. The ones here in the pink/purple color here, those are contaminant levels that are above 50 parts per million. The area here are PCB concentrations that are below 50 parts per million. The other areas -- we have kind of the hatch pattern here -- are a mixture of both POL and PCB contamination, but are much lower in concentration so, again, the idea is we're going to be removing this slab, removing the building, and removing all the soil here around the contaminated area. The other drawing I have is to kind of give you an idea of what the contamination looks like at depth. It's very similar, except we have the areas of higher concentrations and depth is in here and here. And by depth, I'm talking about soils that have been collected down to the water table, which is anywhere between 12 and 15 feet at the site. But again, we're talking about the same type of removal action here. We want to get the soils out, we want to identify the soils doing the excavation process, separate the piles of soils out, and again, they'll be taken off-site for disposal. As far as the schedule, right now we are just completing the IR portion of the investigation. The draft IR document will be issued, here, I guess in another week or so. As far as the removal action, the plan right now is to start the work probably sometime in January of this year. It's my understanding it would take anywhere from 2 to 3 months' time to complete the action. At the same time, we are also completing the feasibility study for the site, and we'll look at other areas of the site that also need to be addressed. So the removal action should be complete sometime in the spring of this year. Later this year, we also hope to have the ROD signed for this OU, which will probably happen sometime in August, later on this year. Any questions I might be able to answer for you?

MR. JIM DUNN: Yeah. I'm just curious. You can clean the concrete and the steel.

MR. KIRK STEVENS: Correct.

MR. JIM DUNN: How do you do that? What is it -- just a washdown, scrub type thing?

MR. KIRK STEVENS: Exactly.

MR. JIM DUNN: And then you can just take, what, the leftovers of the water and stuff you use and run that through one of the other deals?

MR. KIRK STEVENS: You try and minimize water usage if you have dry conditions like we have today for the soils. You, perhaps, could replace the contaminated water with the soils and still not have a slurry, but still just have wet soil, which would go to the landfill or to the incinerator, depending on the level of contamination. It's a very easy wash. A lot of times it's done with a sprayer, like a garden sprayer that you wear on your back, and you spray it, rinse it down, and then -- three times -- and then wipe it. And it -- PCB's are very -- rather easy to clean. In fact, if they -- penetrated deep into the concrete, then sometimes you get into chipping concrete, but that doesn't happen very often.

MR. RICH BONELLI: Anything else?

MR. RAY HUMPHRIES: Where is the natural gas pipe lines going to go? In that area or another area? Or do you know anything about them?

MR. RICH BONELLI: Natural gas pipeline?

MR. RAY HUMPHRIES: Yeah.

MR. JIM DUNN: Pull your map back up.

MR. NEAL PAUL: Yeah. And don't quote me on this, but didn't it follow the railway?

MS. GENA TOWNSEND: No.

UNIDENTIFIED MALE: Yes.

MR. JIM SWARTZENBERG: Well, that's pretty close.

MR. JIM DUNN: Not really. The railway is shown with a straight line right there.

MR. RICH BONELLI: Here's the railroad, here's 24.

MR. JIM DUNN: And the gas line is very close to the rail line.

MR. RICH BONELLI: Is it up here, Jim?

MR. JIM DUNN: It parallels 24 and the rail line. It was put almost in the drainage swell. It's almost in the drainage swell.

MR. THOMAS BURTON: It's outside of that fence line.

MR. JIM DUNN: It's well outside the fence line. It was put in about, say, spring last year?

MR. RAY HUMPHRIES: It won't have any impact, then.

MR. RICH BONELLI: It shouldn't. The area of the work we're going to be deal -- we're mostly concerned about is down here near the building itself. Thank you very much. I guess next will be Scott Bailey -- will be talking to you about Site 89.

MR. SCOTT BAILEY: If I could just make a quick announcement, too. If you have a question for anybody from our group who is speaking, please state your name first for our court reporter. That would be good. If you have any questions, just make sure you state your name. I've got a couple of handouts. All right; first couple of handouts. The document that I'm going to be talking about is something that CH2MHILL produced, that's my employer -- my name is Scott Bailey -- and it's called an EE/CA. I'm going to talk a little about site history, what the EE/CA is, and what the findings of the EE/CA are. It's not a super large document as far as environmental documents go, but it's sizeable, and it's got some nice figures. I would be happy to provide a copy to anyone. If you can give me your name and address after the meeting, I can send you one. Or if you prefer, I've got about a half-dozen copies of it on CD-ROM, and Chris, these are PDF files?

MR. CHRIS BOZZINI: Yeah, they're dirty.

MR. SCOTT BAILEY: So if anyone would like a copy to take home and just pop up and review on a computer, we have that, or we can mail you a copy. I've also got some copies of the briefing that I'd like to pass out. I want to make sure that the folks in the community come. I know everyone else that I work with has read it already, so... Now, Site 89 should be relatively familiar to a lot of people in the room. This is a site that's been talked about before, and it was the focus of a lot of attention about a year ago with a -- what I call dirt cooking across the top of it. And that plays into our EE/CA, as well. Site 89 is located out at Camp Geiger. It's at the very far end of where the old DRMO lot used to be at Camp Geiger, near G and Eighth Streets. It was used as a motor pool for a very long time, close to the initial inception of the facility up until about 1988. Then DRMO, the scrap people, had it for a couple of years. The original reason that the site came into being from the IR program and that point of view -- it's actually -- sort of predates that -- it was investigated as a potential petroleum site because of a waste oil storage tank that was located there and, of course, if waste oils are not handled correctly, they present some environmental issues. And that's the original reason that this site started to pique the interest of the environmental quality people here. Because of that, investigation started in about 1999, and discovered some cleaning solvents in the groundwater. You wouldn't associate cleaning solvents in groundwater with petroleum-type operations. So right away this raises a concern. Subsequent investigations after the initial lot -- and there have been quite a few -- have discovered that contamination was over a much larger area and probably to a greater extent in terms of the amount of contamination than initially thought. And there was an issue with soil, with groundwater, and also what we call the DNAPL, and we're going to talk about it in just a little bit. Now, the surface soil that was contaminated, up until May of this year, initially presented the worst area of concern with the site, because it presented a threat to human health. The concentrations of solvents were so strong in the soils that it actually presented an odor problem just walking across that area of the site. And it was in the topsoils above the water table. There has been some contamination of the solvents that we find at the site in Edwards Creek; that has been detected. The trends recently have been to show that this concentration is actually going down, but they're there. There is contaminated groundwater on the site. Most of it is much higher and much closer to the surface than 50 feet below grade, but as far as we can tell, it does go as deep as 50 feet below the surface. And then we have the real issue, the crux of the matter that we're going to talk about and deal with tonight, and it's one of the more complicated things that you can deal with in environmental contamination. And folks who have reviewed this briefing said make sure you don't get too complicated with the DNAPL, and I said don't worry about it, because I understand that much of things that textbooks are written about. So you'll understand as much as I do in about the next five minutes. So we've got our DNAPL. In simple terms, it is a liquid. It's got a specific gravity that's greater than water, which means it sinks when you put it in water. So a very bad analogy would be a shaker of salad dressing at an Italian restaurant, and you get that bi-layered material. And there we do have the oil on top, and you have the water and vinegar down in the bottom. Well, this is the profile that we would have pretty much underground, except that we would have the water on top and this DNAPL-like mixture of these cleaning solvents beneath it. Our DNAPL is made up of a ~~sweep~~ Suite? of cleaning compounds, but there are two of them, depending on where you go on the site, that just screen right to the top, that are really the two that are -- probably account for anywhere from 85 to 90 percent of the contamination, and that is PCA, which is 1,1,2,2- tetrachloroethane, and TCE, which is trichloroethylene. The source can be types of parts, washers, and general cleaning equipment. We have not really identified the source, and we haven't looked real hard. We don't need to know that right now. We need to address this problem. A simplified view of DNAPL in a very quick, thumbnail sketch; we have the water table. This is an important line to keep in mind, and this is what's -- in terms of this picture, don't worry about the fact that it says residual. Think of it in terms of DNAPL. And we have a release of a solvent mixture, or a mixture that's heavier than water, and it migrates down under the influence of gravity, its own weight. And nothing really happens to it until it bumps into something in the soil profile on the way down. That something that it bumps into can be areas that either retard the movement, or actually help it move a little bit better, or water. And in this case in our example, this little layer that we have right here is clay, and then you can see some clay here and some clay here. And this is pretty good, because this picture looks a little bit like Site 89. We do have an issue with different clay lenses there. It's good and it's bad. When DNAPL comes down and it bumps into clay, now it wants to move along the top of the clay. Sometimes it will just pool on top of it, like you see in this example, and it stays there, and other times it pools and then it migrates under a different pressure. If it's below the water table, sometimes the lateral movement, this flow of groundwater through this profile, will help to push some of this DNAPL off the top of the clay. Then it's under the influence of gravity again to go down until something else impedes the flow. Well, again, that's very simplified, and it's -- I'm not going to get into it much further than that, because I would really be talking over my head; and I'm not afraid to say that, because there are types of books that cover this entire topic. But the most important thing to take away from the picture is that this is complex as this seems. There are different mechanisms chemically, geochemically, and electrochemically that are making this material move in funny patterns underground. This isn't like a dissolved plume; and when I say dissolved plume, if you could think of the earth being a sponge, and you stick that sponge into a glass of tea, and about half of the sponge is saturated. And if you pushed a pencil into that sponge and played around with it and dug a hole in it, you could put your straw in there and pull out tea; and you could pull out tea anywhere you poke that hole, which would represent a monitoring well -- anywhere in the sponge. When you deal with DNAPL, you have a completely different animal, because as you can see, you can put your well in, and you can miss it, or you can get different concentrations of it. So to understand DNAPL requires an awful lot of sampling and an awful lot of complex investigation skills. So for Site 89, when we dissect it and said what are we going to do with it now that we have this problem, the first thing that happened was to take care of the surface soils because that represented a risk to people in the area. And that was fixed between May of 2000 and May 2001; and there was an area where approximately -- depending on the relief of the site, Jim, anywhere from 3 to 5 feet was excavated down to about the groundwater table, wherein it was collected, and it was pushed through a giant kiln, a low temperature thermal desorber on the site to clean that up.

UNIDENTIFIED MALE: I saw it.

MR. SCOTT BAILEY: That was the field trip; right. So you've seen that. That's step 1, phase 1. Step 2 is the issue of this DNAPL. It's critical to take care of the DNAPL next before you address the other water issues at the site, because if you remember back in that picture, there are -- the DNAPL wants to dissolve a little bit into water, so you have this cloggy, tarry mixture, and it slowly dissolves, not real fast, and it gets away from it. Well, that actually makes that plume, that tea in that sponge, and unless you get the DNAPL out of there, you're never going to get rid of any of the dissolved effects. So you can quite possibly put in conventional treatment systems to clean up groundwater in a DNAPL site, and they can operate virtually forever, because you haven't really gotten rid of the source of the material. You still have these big globs of the dissolving material that have to be taken care of. So we're at the phase of getting rid of the big globs. Think of it that way. In the future, after that source is out, once the globs are gone, then we're left with a tea-like mixture, which is a little bit more of a -- it's an easier to deal with solution in the groundwater. And that's in the literature. So we're at this step right now of taking care of that. So we did an EE/CA. An EE/CA -- it's a great regulatory mechanism. It's a document, as well as a process, that comes down from the Environmental Protection Agency, and you can read the paragraph here, and it talks about it being a non-time critical removal and that you -- only contains the data necessary to support the selection of the response and the cleanup, and it sounds like it was written by an attorney describing it. But what it really means is that it's a very focused and efficient analysis of a cleanup selection. The EPA recognizes that there are certain instances when you can go in and look at this site, and if you have enough data, if you've done enough of the right types of investigations, you can apply that to a remedy without having to go through a much longer process that would be typical on a superfund site. So it allows you to get out there and do something quickly. And that's important to us because we're going to save time, and when we save time we're going to save money, and we really need to worry about that, because we're still only in the second phase of this. We still have a larger issue to tackle in the future. In perhaps two years from now, when this is all done and put to bed, Site 89 won't go away. So keep that in mind, also. The purpose of our EE/CA is to identify the objectives, why we're going to do and how we're going to do what we want to do, analyze the effectiveness, and also analyze the implementation of these remedies and the costs, bearing these really drive the EE/CA. So we have a bunch of data about this site, and we have a bunch of people who work with this kind of stuff for a living, and they sit down, and right off the top of their head they can say we've dealt with this before, studied this before, we had a site like this in New Jersey once. We can come up with four or five things off the top of our head, sometimes more than that. I bet they would work here. Now let's work through the process and prove to ourselves that we have enough experience and enough commonality and enough understanding where we can get to that without having to analyze every possible technology under the sun. We compare everything, and we screen it, and we reach a selection. We pick a preferred remedy for this site, and then we take it through design and implementation. These are not part of the EE/CA's. I don't have information to talk to a great extent about some of the design issues. I mean, I can because I know about it, but we haven't gone through that concrete yet for Site 89.

MR. RICH MULLINS: I have a question.

MR. SCOTT BAILEY: Sure.

MR. RICH MULLINS: I just realized I think I'm lost.

This is something that was just done, this EE/CA, or is being done?

MR. SCOTT BAILEY: We just completed it.

MR. RICH MULLINS: Okay, because when I'm looking at objectives of remedial action, I'm thinking wait a minute, this is something that was done before they started cooking the dirt and everything, right? Or is it something that's ongoing?

MR. SCOTT BAILEY: Well, that was done for that phase of it. That was one specific element. That was a time critical removal action, and this is a non-time critical, so each one of --

MR. RICH MULLINS: Okay, I --

MR. SCOTT BAILEY: -- these remedial actions, right, has its own set of objectives.

MR. RICH MULLINS: I got it.

MR. SCOTT BAILEY: Now, there is an overall set of objectives for the entire site, and that's when I keep saying we have to come back to the groundwater issue. And the bigger picture of the site gets addressed in the whole formal process that you hear about all the time here in the RAFS - RI FS

MR. RICH MULLINS: Well, considering only one of these was done up front for the whole project, I mean, there are different phases within --

MR. SCOTT BAILEY: Each states --

MR. RICH MULLINS: -- and it has its own supporting EE/CA, doesn't it? Sort of.

MR. SCOTT BAILEY: If it is a non-time critical, correct. Yeah, you start to get into specific issues about the regulations and where you are in the CERCLA process, right. There are times when the EE/CA is required. The objectives that we're facing to try and get rid of the DNAPL are, of course -- I mean, this drives environmental work -- remove any risks to human beings or to ecological receptors. Fortunately, this site has come into a non-time critical phase, because we've spent the past year taking care of the critical issue that could have really -- I don't want to say, so I won't say it. We took care of the issue that could impact people with the vapor if you were right on top of this site. That's gone, so we've moved on to a non-time critical phase. So again, it gets back to DNAPL. Before we do anything else, we have to concern ourselves with that. So we want to prevent and minimize the DNAPL from going anywhere else. Let's try and bound it; let's try and assure ourselves that we know with some certainty of where it is, and then let's get it out of there. Now, we started out with seven or eight different technologies, and right away, when we went through the process, there were a couple of them that fell out because they were -- they just seemed very costly, or they were still in a part of technology development where they were being used as part of research studies or pilot testing, and we didn't want to come out and make that proposal to the Navy or to the Marine Corps to try something that we weren't absolutely certain of. So that's why we were able to narrow it down to four of them quickly that we will pursue further. A picture that we can pass around and that I will show, and we'll have up here later for future discussion, if you would like, deals with the close-up of Site 89, and I'll show you these boundaries right now. These are the areas when we talked about where we think the DNAPL is located, fall within these boundaries. This gold line and this dash line; and I'll explain the dashes in a minute. This gold line here, followed by this dash line. And you can see just some of the sample density here. There have been an awful lot of environmental samples collected in this area, but we do have two discreet areas where we feel that we have the DNAPL condition that we want to fix. Now, when you look at it, you say okay, the dash line usually means on a drawing it's something that's hidden underground or it's incomplete. Which one is it? Well, in this case, it means that it's incomplete. The very last round of analysis when we got into the field -- and we only had so much time and we only had so much money. And as we started to pursue working into this area and following it -- and you'll see where the number of dots kind of fall up in this area, and they're a little slim here -- we ran out of time and money. So for the purpose of getting to this point in the EE/CA, we had to put our own overly conservative boundary on it, we hope, so that we could compare all of these technologies, and we could say we have this much volume of soil, we have this much of a volume of water. But this is just sort of an arbitrary end. Now, it doesn't concern us at the point in the project that we're on right now, because we're not at the design phase yet, and as we drift into design, we can work with the specialized contractors who clean this to actually make getting some data in here part of their design. So we won't hit the field completely blind and running. This will get taken care of. But we don't necessarily have to spend the time to collect this data right now for the purpose of our EE/CA.

MR. JIM SWARTZENBERG: Those green dots; are those wells?

MR. SCOTT BAILEY: No, the --

MR. JIM SWARTZENBERG: Zoomed in or are those spots that aren't?

MR. SCOTT BAILEY: Well, the green dots -- gosh, there are so many of them -- this is -- this was a different type of boring. There were three or four different types of screening technologies employed out here, and I believe the green ones have what's called a ribbon sampler that was placed into them, and there was membrane interface probes, and there's die-shape testing. And then you can also use a head space analysis of the volatile fraction of -- there's just so many different ways to look at the DNAPL.

MR. JIM SWARTZENBERG: Those are the sites where you made -- conducted the tests.

MR. SCOTT BAILEY: Yes. They represent different samples, different tests.

MR. JIM SWARTZENBERG: And the red dots are the hot ones?

MR. SCOTT BAILEY: No, actually the red ones represent a boring instead of a push, just a different way of collecting the sample, also with a ribbon sampler.

MR. JIM SWARTZENBERG: Oh, all right.

MR. SCOTT BAILEY: Yeah; but there's a variety of ways that you have to go in and characterize the DNAPL site because of the nature of DNAPL and how it's influenced by different layers of clay, or different types of sands or silts -- and Site 89 has a lot of them. You can push a point right here, and you can push one right here, and collect a sample at the same depth, and get two entirely different answers. And it's even worse when you're in rock, and I dealt with a site like that in Tennessee once. That was pretty wild, interesting. The technologies we reviewed: steam injection; electrical resistive heating -- ERH is much easier to say; dynamic underground steam stripping -- DUS is easier to say; and then a -- I want to say it's a hybrid, but the people who work with it would laugh at me. But it's a combined vacuum enhanced recovery, pneumatic fracturing in-situ chemical oxidation/reduction. How do these work? In a nutshell, steam injection, you auger in steam injection points. It's a special type of well that injects steam at varying pressures to heat the subsurface and get those DNAPL's warm. And remember that they're solvents, and you can actually get these things to a temperature that makes them want to turn into a vapor, just like you boil water, and that's pretty much what the technique like this does. And then you have a vacuum system over the top of it. One of the things that makes the DNAPL difficult is it's almost -- I don't want to say it's almost impossible, but to do it correctly takes forever to pump it. It's not like groundwater. We can have a plume of DNAPL here, and we could have put a well right next to it. But because the DNAPL is heavier, it doesn't want to move. And remember that when you're pulling things from a well, the fastest water that wants to get to the well -- because the well is actually driven by gravity; the pump just helps it get closer to the surface -- it's been right next to the sides of it. So unless you have wells right in the middle of these little pockets of DNAPL, it would take forever to clean them up. So that's why we want to go down with a very aggressive method like this and use heat to boil all of that stuff and turn it into vapor and vacuum it out. Now the issues, both good and bad, with steam injection; it's aggressive cleanup technology -- great; we don't want to be out there forever. There are steam lines out at Camp Geiger, and there's a chance that steam would be available at a reduced cost; that's good. One of the drawbacks to it is that because you are injecting something under pressure and, depending on how much heating you want to do -- and these are things that would fall out in design -- you may have to increase your pressures. Well, you can actually break the soil. So instead of getting the steam to migrate through the porous spaces and keep the soil hot, you've created a fissure. Now the preferred path for the steam is not where you want it to go, but up through this crack into the surface. So that's potentially an issue. It doesn't work as well with clay as other methods, and we do have clay out there. In fact, one of the benefits of the site is that fairly consistently across Site 89, there is a layer of clay approximately 20 feet below ground surface. We're fairly confident that that's holding the DNAPL, so as that DNAPL wants to come down and migrate into these different ganglia as it hits little tiny pieces of clay and clay lenses, it's hitting a shelf of clay, a floor, and it's staying there. So this is pretty important. If the clay is -- if you can find something that will make the clay hot, you can more readily cook things off the top of it. And, of course, off gas treatment is required. If you want to boil something and turn it into a vapor, and you're going to vacuum it out of the ground, you better be prepared to handle those vapors. The ERH, or the resistive heating, is very similar to steam in concept. You're getting the subsurface very hot. In fact, you can get to the boiling point of water very easily. You're pushing electrodes into the ground and you're passing current between the electrodes. And that's how you get your heating; so it's a shock therapy for the soil. Again, it's aggressive cleanup technology. It's much more effective in clay, because of electrical conductance, than steam would be. You still need to treat your off gases, because you are going to push volatiles up to the surface, and you are going to collect them with a vacuum, but you also have to deal with power. There is a chance that some power would be available to us at a reduced cost, but we're not banking on that. When we did our cost analysis we threw in what we felt was a reasonable power cost. Dynamic underground stripping, or DUS, is a combination of the two. You can use steam and electricity in combination in a fine tuned system to heat the ground and do the same type of process. So because you are actually using a combination of the two, you wind up with positives and negatives that are a combination of the two. So while you can really tailor it to suit different specific areas of your site, you also have the drawbacks. You have the potentials of fracturing things, because the steam line -- you have a steam injection point that you're really not going to use, so you have to put an electrical point in there, and you go back and forth. Now, you could overcome that with a good design and a good bit of -- amount of pilot testing. So that's -- it's not a technology that's out of the question for sites like this. And then the fancy -- what I like to call a hybrid; this is -- just look at all of the actions we have in here. We have vapor recovery, we have fraction, we have fracturing, we have chemical destruction, we have all of these things; and you look at this and you read into it a little bit, and for me, personally, it's as complicated to describe it as it sounds, and when I see that I say gosh, this has to be difficult and -- to the field. And, in fact, it is. You need an awful lot of pilot testing, and it takes a very long time to do it because as you are combining technologies to break soil out of the way to open up a pool of DNAPL, and then trying to pull some of it out with vacuum, and trying to figure out which chemical should be injected here to do all of this, you've got a big Ph.D. level research project going on. And in my view of the world, you've got a bunch of folks in a trailer scratching their head trying to figure out exactly how to get it just right. Whereas in engineering, you look back and say gosh, I bet if we'd have been in there with steam or we'd have been in there with electricity, we'd be home by now. Costing: obviously, money drives the world, so we reviewed cost. Steam injection for the site, for the two areas that we've talked about here, we'll call them our right and our left lobe; just over $2,000,000 for steam. About two and three-quarter million for the electrical heating. The dynamic stripping, which is a combination of those two, is just over three million, and this hypertechnology comes in at just under three million. Now to evaluate the technologies, we've gone through a very detailed analysis, and you'll see that if you actually read the EE/CA report. But to sum it up, we take each one of the technologies, or four preferred, and we look at their effectiveness. What's the likelihood that they'll work at a site like this? Implementability. Is it reasonable to think that you can come up with a design that will work at this site that you can actually bid to someone and a contractor can come up with? Where did it fall out in terms of cost? And then we rank them. The most effective, or the -- and the greatest chance or greatest probability -- a ranking system. Number one, the best one, winds up with a score of one in any of the categories, and the lowest one winds up with a four. So the low score wins in our mind right now, based on the data. That's a four, and that's the electrical resistive heating. Now, there's some -- there are -- it's going to be heat. Steam, you can see, is very close. It's only off by two. The DUS technology, it's a little higher than these. So you can see that in all likelihood -- you're centered on trying to boil this stuff out from under the ground and collect it in vapor. Based on the information that we have, and the understanding of the technologies and our experience with them, we think that the electrical heating is going to be the way to go.

MR. JIM SWARTZENBERG: You only need one -- you don't need a --

MR. SCOTT BAILEY: Right.

MR. JIM SWARTZENBERG: -- need two. Unless you --

MR. SCOTT BAILEY: Right, unless you do the steam, too. And a quick summary of the electrical heating -- and I'm anxious to get out and see something like this, because I haven't worked on a site where we've tried anything like this. I remember when the talk was with heat technologies to turn everything into glass, in-situ vitrification. That's -- that would be fun to try here, too. But we've got -- now -- just over 13,000 volts, what they call local service, and as Jim indicated to me before, yeah, that's local service, but that's your primary. That's what's going down -- and your -- most of the streets that you have, your subdivision, most of us have a primary of about 13,000, and it's stepped down a couple of times in transformers to actually wind up at your house. You have to look at how close this actually is to the site. But if you can start off with this service and bring it down to 480 -- 3-phase industrial power that is readily available in most areas, insert a series of electrodes, wire them up -- let the electrical engineers, the electrical specialists, and the other people have their time with it and tune the system -- you actually develop this hot area. And this area does get hot enough to boil water if you need it to be that hot. And they make a determination. When they look at this data and they look at all of our concentrations and things and everything in here, and the contractors are able to run through with a computer model and determine how hot and for how long to remove the material that we're talking about. Now on this particular picture -- and this is just sort of a predesigned what if kind of thing that you throw around -- the four technologies that we looked at have very, very, very, very high level of certainty of being effective on the site, but the chances are that when we talk to the contractors -- there's an area located in the middle of this right lobe that is a higher concentration of the DNAPL material than we feel exists in this area. So it's very likely that when, actually, specifications get written for the project to talk to the different groups, that we will look for a higher removal rate in this central area than we will in some of the remaining areas, and again, that's just a minor point to let you know we've thought about it that far; because our purpose is to remove that DNAPL.

MR. JIM SWARTZENBERG: I'm looking at the picture here of one of these electrical probes that go under the ground. You don't do the whole site at one time, do you?

MR. SCOTT BAILEY: You can do a very large portion of it.

MR. JIM SWARTZENBERG: You do?

MR. SCOTT BAILEY: You sure can. In fact, the way that we costed the project was to run 200 electrodes. I don't remember off the top of my head if we were doing 100 electrodes, or 150 and then a smaller number here, or if it was some fraction of that, 200 at one time and then maybe this. But you can run a very large number of electrodes. It's more than just a handful of these. See, you're not --

MR. JIM SWARTZENBERG: So you'll be doing a good portion of the whole site?

MR. SCOTT BAILEY: Correct. You're not doing -- and we know that looks like Swiss cheese. We're not going to take a small part here and then a nibble here and then a nibble here, no. This is a get in there, install a bunch of electrodes, power them up, and in a few months, have the project completed.

MR. JIM SWARTZENBERG: Heated up for several months?

MR. SCOTT BAILEY: Yep. It takes several months to cool down.

MR. JIM SWARTZENBERG: How do you -- how far down do the electrodes go?

MR. SCOTT BAILEY: The electrodes in this example are probably going to have to get down to about that 20-foot level, because that's where that clay shelf is --

MR. JIM SWARTZENBERG: It's going to be below the clay level.

MR. SCOTT BAILEY: Right. It's supporting that DNAPL, and we want to make sure that we get that clay hot, because if we can get all of that hot, it's going to help boil and drive off some of that DNAPL. So we're going to want to make sure we get that clay hot. Now, from a technical point, too, you want to make sure that you get the clay hot, because as you're boiling all of this water, you're creating quite a disturbance down here, and you're taking this very dense fluid -- you get it warm -- it's like putting -- you make popcorn in your house, and you get that pan hot, and you put that oil in it. Well, it doesn't take long before that oil is not thick, it's like water. You can substantially reduce the viscosity of this, where if you don't have a system that's designed large enough, and you've made the material very thin right now, and very slippery, you can have it spilling over the edges of this clay, or you create a hole in the clay, and you make it want to go deeper.

MR. JIM SWARTZENBERG: Make it worse.

MR. SCOTT BAILEY: Yeah. So when we do a field trip out there, you can ask that question of the guys who are running the system. Now are you keyed into the clay --

MR. JIM SWARTZENBERG: Yeah, that's what I'm thinking.

MR. SCOTT BAILEY: Right.

MR. JIM SWARTZENBERG: What happens when you heat all this groundwater up? The groundwater is going to go out into the creek and stuff, right?

MR. SCOTT BAILEY: Yeah. Good question.

MR. JIM SWARTZENBERG: Is it going to be warm water?

MR. SCOTT BAILEY: Right. No -- again, that's a design element, right; how far can we take it to the creek? Yeah, we don't want to be boiling water in the creek, that's not acceptable. Because that's a thermal impact to Edwards Creek, and we don't want to do that.

MR. JIM SWARTZENBERG: I hope not. And besides that, won't some of the DNAPL go out with the groundwater?

MR. SCOTT BAILEY: No, it should not, because we would bound it when we would start in here. And again, if this is a design -- and I'd like to talk to the specialists who do it, but in my mind, I would think that you would want to start in the hotter area and then, perhaps, try and do a boundary here and work back.

MR. JIM SWARTZENBERG: How are you going to do it?

MR. SCOTT BAILEY: What's that?

MR. JIM SWARTZENBERG: How do you do the boundary?

MR. SCOTT BAILEY: With heat. Put a series of electrodes in here and come back this way.

MR. RICH BONELLI: Basically you're boiling the DNAPL.

MR. SCOTT BAILEY: You boil it out, right. You're not going to push it. You shouldn't push it. And that's one reason that you want to make sure that you start on the outside edges of it, and you start with very conservative estimates.

MR. JIM SWARTZENBERG: But at the same time, all this groundwater is flowing through there.

MR. SCOTT BAILEY: Very slowly. Four feet a year at most.

MR. NEAL PAUL: Yes; right. Groundwater flows slow.

MR. RICH MULLINS: And Jim, the other thing is, we do have the secondary measure of the basalt to the bubbler over in the creek, making sure that at the boundary of our site -- that makes sure that any contaminants that do make it into that creek will be treated by the bubbler before they're discharged farther down from the site.

MR. JIM SWARTZENBERG: Okay. Well, my main concern was the groundwater. I saw all that blue, and it looked like a little river down there. Figured I'd call Phil up and say hey, everything's going well.

MR. SCOTT BAILEY: We can only hope.

MR. JIM SWARTZENBERG: Wipe the (inaudible) out with a (inaudible).

MR. SCOTT BAILEY: Right.

MR. RICH MULLINS: First of all, Jim, that vapor deal.

Are you going to -- is that like a centrally located tube that goes down that sucks all that stuff out, or are you going to put down tarp over the top of the surface?

MR. SCOTT BAILEY: Yeah, it's very likely.

MR. RICH MULLINS: Okay.

MR. SCOTT BAILEY: Yeah, you'll probably have -- again, not knowing enough about the design, but I would imagine that you've got a couple of vacuum headers, and you could either have vertical points, or you could have horizontal points, or probably a combination of both, but that's part of the testing and the design work before you go out there. We --

MR. RICH MULLINS: The vacuum helps direct where the vapor goes.

MR. SCOTT BAILEY: That's how you get control of it, yeah. You control this with the heat and the duration of heat, and the vacuum.

MR. JIM DUNN: The vacuum also causes you to have to apply less heat, because it lowers the temperature at which it boils just by the suctioning --

MR. SCOTT BAILEY: Pretty strong vacuum.

MR. CHRIS BOZZINI: I've got a picture of -- this is actually a setup inside a building, and we'll just pass it around and let you get an idea of -- it's basically well headers that are connecting the vapor.

MR. SCOTT BAILEY: The technology has been available commercially, I guess, for about 12 or 15 years. The Department of Energy pioneered slightly -- there were a couple of different forms that hit the market using different types of electricity and different types of electrodes, but it's been around for a long time. It's not really a -- it's not considered -- it's leading edge technology, but it's not considered so innovated where it's a coin toss. Sometimes when you buy innovation, innovation doesn't always mean that it's proven.

MR. RAY HUMPHRIES: Question.

MR. SCOTT BAILEY: Yes.

MR. RAY HUMPHRIES: How deep is that aquifer on that area?

MR. SCOTT BAILEY: The aquifer in this area -- well, groundwater actually starts in the surface at times of high -- nondrought conditions, not like now; probably as shallow as about five feet, and it runs down. And then drinking water -- Rich, help me out. Where does the Castle Hayne start about here? 40?

MR. RICH BONELLI: Forty-five feet, 40 feet.

MR. SCOTT BAILEY: Forty-five to 50 feet. So that the higher quality water is down much deeper than where our DNAPL is located.

MR. RICK RAINES: So our clay lens is not the confined layer between the superficial aquifer and the groundwater aquifer.

MR. SCOTT BAILEY: No.

MR. RICK RAINES: I mean, we're taking advantage of another confining layer that's directly under the surface.

MR. SCOTT BAILEY: Yeah. Taking advantage of good qualities.

MR. RICK RAINES: And hopefully in the right spot.

MR. RICH MULLINS: So would it be better to do it now in a drought condition than when there is water in there, or is it better if there's -- or does it matter?

MR. SCOTT BAILEY: That's a good question. If you've got more water and you apply more current, you get a bigger thermal mass, you boil a little bit -- I don't know. I don't know. That's a good question. But our DNAPL winds up existing in a lens at about 10 to 20 feet below grade -- is where the most of the DNAPL stays in that zone.

MR. RICH MULLINS: If we need water, just hook it up to emergency --

MR. SCOTT BAILEY: Yeah, that's right, when you look at it that way. Now, I've taken the liberty of putting in a brief project schedule. These are not -- except for tonight of December 4, '01 -- these are not hard dates. This is just my company taking a stab at the way we think that the Navy is likely to run with this, because they hold the money here. But we hope to have our final technology selected by next month. That's absolutely doable. And these are really the dates that float around a little bit in terms of developing a contract and the design for the subcontractors. Sometime in this spring, perhaps get out into the field as early as late spring, early summer of '02, and then 6 to 12 months in the field. And that should -- that's going to get rid of that DNAPL. Then we just have a very big groundwater issue. That's not nearly -- to the environmental professionals who work with contamination underground, a big groundwater issue doesn't scare them like a big DNAPL issue. So the site becomes much more manageable within the next two years. And again, we've got hard copies of the report if you prefer that over a CD-ROM, and we'd be happy to provide that, as well.

MR. JIM SWARTZENBERG: What do you have to have to read that CD-ROM?

MR. SCOTT BAILEY: I think it's just an Adobe Acrobat. It's a PDF file format. If you put it in, and I think that Windows is set up to where it will automatically read new media and put it into the computer, it may just open it up. If you find any spelling errors, let us know. Well, thank you very much.

The meeting was concluded at 8:03 p.m.

STATE OF NORTH CAROLINA)

) C-E-R-T-I-F-I-C-A-T-I-O-N

COUNTY OF LENOIR)

I, KATHRYN F. KILPATRICK, A COURT REPORTER AND NOTARY PUBLIC IN AND FOR THE AFORESAID COUNTY AND STATE, DO HEREBY CERTIFY THAT THE FOREGOING PAGES ARE AN ACCURATE TRANSCRIPT OF THE PUBLIC MEETING CONCERNING OPERABLE UNIT (OU) 19, SITE 84, AND OPERABLE UNIT (OU) 16, SITE 89, WHICH WAS TAKEN BY ME, BY STENOMASK, AND TRANSCRIBED BY ME PERSONALLY.

I FURTHER CERTIFY THAT I AM NOT FINANCIALLY INTERESTED IN THE OUTCOME OF THIS ACTION, A RELATIVE, EMPLOYEE, ATTORNEY OR COUNSEL OF ANY OF THE PARTIES, NOR A RELATIVE OR EMPLOYEE OF SUCH ATTORNEY OR COUNSEL.

WITNESS MY HAND AND SEAL THIS DATE: FEBRUARY 7, 2002.

MY COMMISSION EXPIRES MAY 2, 2006.

KATHRYN F. KILPATRICK, NOTARY PUBLIC, LENOIR COUNTY, N.C.

Kathryn F. Kilpatrick

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